EXPERIMENTAL STUDY ON PROPERTIES OF CONCRETE WITHPARTIAL REPLACEMENT OF CEMENT WITH RICE HUSK ASH

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Abstract

In India rice milling produces a by product which is known as Husk. This husk is used as fuel in rice mills to produced steam for boiling process .This husk contain near about 75 % organic matter and the remaining 25% of this husk is modified into Ash during the firing process which know n as rice husk ash (RHA). The rice husk ash (RHA) contain near about 85 % to 90 % amorphous silica. By using rice husk ash in concrete , we can improve the properties of concrete . The current study and experimental investigation were taken to study the pro perties of concrete made with Rice husk ash . the replacement is done partially in the proportion of 0% ,20% and its effect on workability of concrete made with rice husk ash were investigated for the 20% rice husk ash replacement ,the hardened properties such as compressive strength observed were good as compare to 0 % RHA . The compressive strength test was conducted at 0 % and 20 % rice husk ash replacement and the highest compressive strength at 20 % RHA replacement as compared to 0% RHA replacement at 14 ,21 and 28 days.

1.0 INTRODUCTION

The need to reduce the high cost of Ordinary Portland Cement in order to provide accommodation for the populace has intensified research into the use of some locally available materials that could be used as partial replacement for Ordinary Portland Cement (OPC) in Civil Engineering and Building Works. Supplementary cementitous materials have been proven to be effective in meeting most of the requirements of durable concrete and blended cements are now used in many parts of the world (Bakar, Putrajaya, and Abdulaziz, 2010). Various research works have been carried out on the binary blends of Ordinary Portland Cement with difeerent pozzolans in making cement composites (Adewuyi and Ola, 2005; De Sensale, 2006; mortar and found that pozzolans with finer particles had greater pozzolanic reaction. This research work examined the use of Rice Husk Ash as partial replacement for Ordinary Portland Cement in concrete. It invoved the determination of workability and compressive strength of the concrete at different level of replacement.

2. MATERIALS AND METHODS

2.1 Materials

2.1.1 Cement

Cement is a binding material which possess very good and cohesive properties which make it possible to bond with other materials to form a compact mass. Ordinary Portland cement is the most commonly used cement for general engineering works. The specific gravity of all

grades namely 33, 43 and 53 grades. In this project Ordinary Portland Cement of 53 grades is used for experimental work. Initial and final setting time of the cement was 30 minutes and 600 minutes.

2.1.2 Coarse Aggregate

Coarse aggregate for structures consists of material within the range of 5mm to 150mm size. Rocks having water absorption value greater than 3% or specific gravity of less than 2.5 are not considered suitable for mass concrete. However, in practice mixes of same workability for round shaped aggregates required less water than angular shaped aggregates.

2.1.3 Fine Aggregate

The fine aggregate used was locally available river sand without any organic impurities and conforming to IS: 383 – 1970. The fine aggregate was tested for its physical requirements such as gradation, fineness modulus, specific gravity and bulk density. A concrete can be made from sand consisting of rounded grains as good as form that in which the grains or granular.

2.1.4 Water

Water is an important ingredient of concrete as it activity participates in the chemical reaction with cement and potable water available in laboratory with pH value of not less than 6.5 and not more than 8.5 conforming to the requirement of IS 456 2000 were used for mixing concrete and curing the specimen. The water which is fit for drinking should be used for making concrete.

2.1.5 Rice Husk Ash (RHA)

The Rice Husk used was obtained from Ile Ife, Nigeria. After collection, the Rice Husk was burnt under guided or enclosed place to limit the amount of ash that will be blown off.. The ash was ground to the required level of fineness and sieved through 600 μm sieve in order to remove any impurity and larger size particles.

(fig 1. Rice Husk Ash)

2.2 Concrete Mix Design

The concrete used in this research work was made using Binder, Sand and Gravel. The concrete mix proportion was 1:1.5:3 by weight. 2.4. Casting of samples Cubic specimens of concrete with size 150 x 150 x 150 mm were cast for determination of all measurements. Three mixes were prepared using different percentages of 0 and 20 RHA. The concrete was mixed, placed and compacted in three layers. The samples were demoulded after 24 hours and kept in a curing tank for 7, 14 and 28 days as required. The Compacting Factor apparatus was also used to determine the compacting factor values of the fresh concrete in accordance with BS 1881: Part 103 (1983). 2.5. Testing of samples The compressive strength tests on the concrete cubes were carried out with the COMTEST Crushing Machine in the laboratory. This was done in accordance with BS 1881: Part 116 (1983). The sample was weighed before being put in the compressive test machine. The machine automatically stops when failure occurs and then displays the failure load.

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(fig 2. Casting of cube)

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3. RESULTS AND DISCUSSIONS

3.1 Results of compacting factor test on fresh concrete samples

The results obtained from the compacting factor test on fresh concrete samples are given in Table 1.

Table 1: Compacting factor values of RHA concrete

Percentage replacement of RHA (%)	Compacting Factor values
0	0.91
20	0.88

The table indicates that the compacting factor values reduce as the RHA content increases. The compacting factor values reduced from 0.91 to 0.88 as the percentage RHA replacement increased from 0% to 25%. These results indicate that the concrete becomes less workable (stiff) as the RHA percentage increases meaning that more water is required to make the mixes more workable. The high demand for water as the RHA content increases is due to increased amount of silica in the mixture. This is typical of pozzolan cement concrete as the silica-lime react it requires more water in addition to water required during hydration of cement (Bui et al. 2005).

3.2 Result of compressive strength at different curing days

Compression test is the most common test conducted on harden concrete, partly because it is an easy test to perform, and partly because most of the desirable characteristics properties of concrete are qualitatively related to its compressive strength.

The compressive test is carried out on specimen cubical or cylindrical in shape. Sometimes, the compression strength of concrete is determined using parts of a beam tested in flexure. The end parts of beam are left intact after failure in flexure and since the beam is usually of square cross section, this part of the beam could be used to find out the compressive strength.

(fig.3.Testing of Specimen)

Table 2: Compressive Strength Test Result

	Compressive strength in N/mm²	
DAYS	(0% of RHA)	(20% of RHA)
7	21.98	20.20
14	27.14	28.22
28	35.87	36.85

4.CONCLUSION

To determine the various test results on hardened concrete design mix of M20 such as compressive, flexural and tensile and compared with the control mix of both river sand and M sand. There is gradual decrease in strength of test of 7 and 28 days. It can be used for light weight structures and also resists with sulphate attack.

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